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BRITISH
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June 1972

1,277,416

COMPLETE SPECIFICATION

2 SHEETS

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SHEET 2

(Makin)

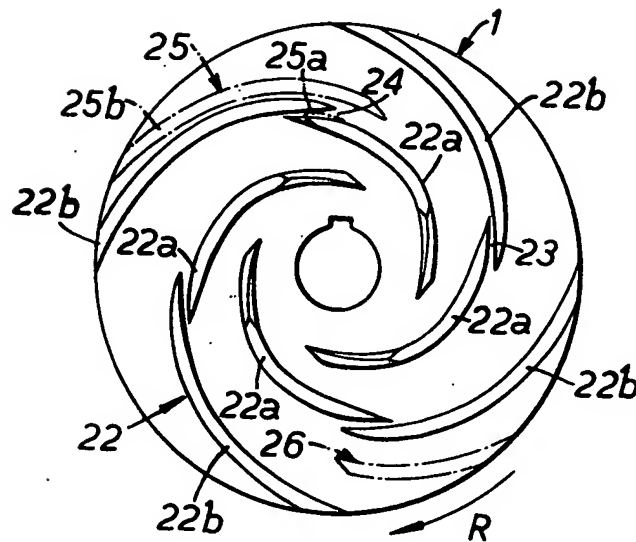


FIG. 2.

PATENT SPECIFICATION

(11)

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DRAWINGS ATTACHED

1 277 416

- (21) Application No. 29120/68 (22) Filed 19 June 1968
 (23) Complete Specification filed 9 June 1969
 (45) Complete Specification published 14 June 1972
 (51) International Classification F01D 5/00 5/14
 F04D 29/24
 (52) Index at acceptance
 FIC 2F1
 FIT 2A 2G 2X B1H1 B1H2 B2K
 (72) Inventor CLIFFORD MAKIN



GREAT BRITAIN
 GROUP 343
 CLASS 415
 RECORDED

(54) IMPROVEMENTS IN OR RELATING TO VANED AND BLADED ROTORS

(71) We, MAKEARN HOLDINGS LIMITED, a British Company, of Granville House, 59, Brunswick Road, Gloucester, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to vaned and bladed rotors the vanes or blades of which during operation act to impart to the fluid flow through or past the rotors a change in the radial flow component. It is thus concerned with the impellers of radial flow and so-called "half-axial" machines. "Half-axial" is a term used in the art to cover machines which are partly radial flow and partly axial flow in function, an alternative term which is sometimes used being "part-axial". The invention will be described more particularly herein with reference to centrifugal pump impellers, but it is to be understood that it is not so limited in its application. For example, when appropriate the various features described may be utilised with the vanes or blades of a turbine rotor.

All vaned or bladed rotors, particularly pump impellers, suffer loss of efficiency due to eddying or cavitation on the low pressure side of the vanes or blades, and one object of the invention is to provide centrifugal and half-axial impellers of improved efficiency due to a reduction in the tendency to eddying or cavitation.

According to the invention a vaned or bladed rotor for a radial flow or half-axial machine comprises a plurality of vanes or blades extending from adjacent a central region to the outer periphery of the rotor each of which is separated into two portions which are both radially and circumferentially staggered to provide an overlap in the region of a passage between them, which passage is inclined with respect to the radial direction to provide a flow through the passage from

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the high pressure side of the vane or blade to the opposite low pressure side thereof during rotation of the rotor, the arrangement being such that as a result of the circumferential staggering the radially outward of the two portions overlaps the inner portion on said high pressure side and the overlapping end of the portions are arranged to direct a substantially streamline flow through the passage and smoothly towards the low pressure side of the outer of the overlapping portions.

The term "radially staggered" is used herein to mean that, in the radial sense, the two portions of each vane or blade are relatively displaced to increase the overlap as compared with forming said passage by merely slotting or splitting the vane or blade to divide it into two portions. Thus, an arc struck about the rotor axis and touching the overlapping end of one of the portions will intersect the other portion.

In order to increase the pressure ratio still further for a given specific pump speed a plurality of passages may be provided in said plurality of vanes or blades. In this case the vanes or blades will each be effectively divided into several separated portions provided with said radial and circumferential stagger. For strengthening purposes the vane or blade portions may be joined by one or more relatively narrow ribs extending across each passage.

Said plurality of vanes or blades will normally be symmetrically arranged with respect to the rotation axis whereby to provide a balanced arrangement. Said plurality may provide all or only some of the vanes or blades of the rotor, and the adjacent ends of the separate vane portions may be rounded off to improve the generally streamline flow through the corresponding passage.

The invention materially reduces eddies and fluid counter-flow, and reduces the pressure differential between low and high

particularly described with reference to centrifugal pump impellers, it will be appreciated that it is of application generally to the rotors of machines which in operation act upon or are acted upon by the fluid. It will also be appreciated that the staggered vane arrangement of the first modification illustrated can also have a plurality of passages between the vane portions at different intermediate radial flow position.

WHAT WE CLAIM IS:—

1. A vaned or bladed rotor for a radial flow or half-axial machine, comprising a plurality of vanes or blades extending from adjacent a central region to the outer periphery of the rotor each of which is separated into two portions which are both radially and circumferentially staggered to provide an overlap in the region of a passage between them, which passage is inclined with respect to the radial direction to provide a flow through the passage from the high pressure side of the vane or blade to the opposite low pressure side thereof during rotation of the rotor, the arrangement being such that as a result of the circumferential staggering the radially outward of the two portions overlaps the inner portion on said high pressure side and the overlapping ends of the portions are arranged to direct a substantially streamline flow through the passage and smoothly towards the low pressure side of the outer of the overlapping portions.
2. A rotor according to claim 1, wherein the adjacent ends of the separate vane or blade portions are rounded off to improve the generally streamlined flow through said passage.
3. A rotor according to claim 1 or claim 2, wherein a series of additional short vanes or blades which extend inwardly from the

periphery of the rotor and which terminate at an intermediate radius are positioned between a series of main vanes or blades which extend across the full effective radial width of the rotor and which provide said plurality of vane or blades.

4. A rotor according to claim 1 or claim 2, wherein each of said vanes or blades has a plurality of said passages at spaced intermediate radial flow positions, whereby effectively to separate that vane or blade into several spaced portions.

5. A rotor according to any of the preceding claims, wherein said vane or blade portions project separately from a backplate of the rotor.

6. A rotor according to claim 5, wherein the rotor is fully shrouded with said vane or blade portions extending between said backplate and a front plate of the rotor.

7. A rotor according to any of the preceding claims, wherein the rotor is designed to operate as a centrifugal pump impeller.

8. A pump or turbine embodying a rotor according to any of the preceding claims.

9. A centrifugal impeller constructed and arranged substantially as herein particularly described with reference to Figures 1 and 2 of the accompanying drawings.

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SHEET 1

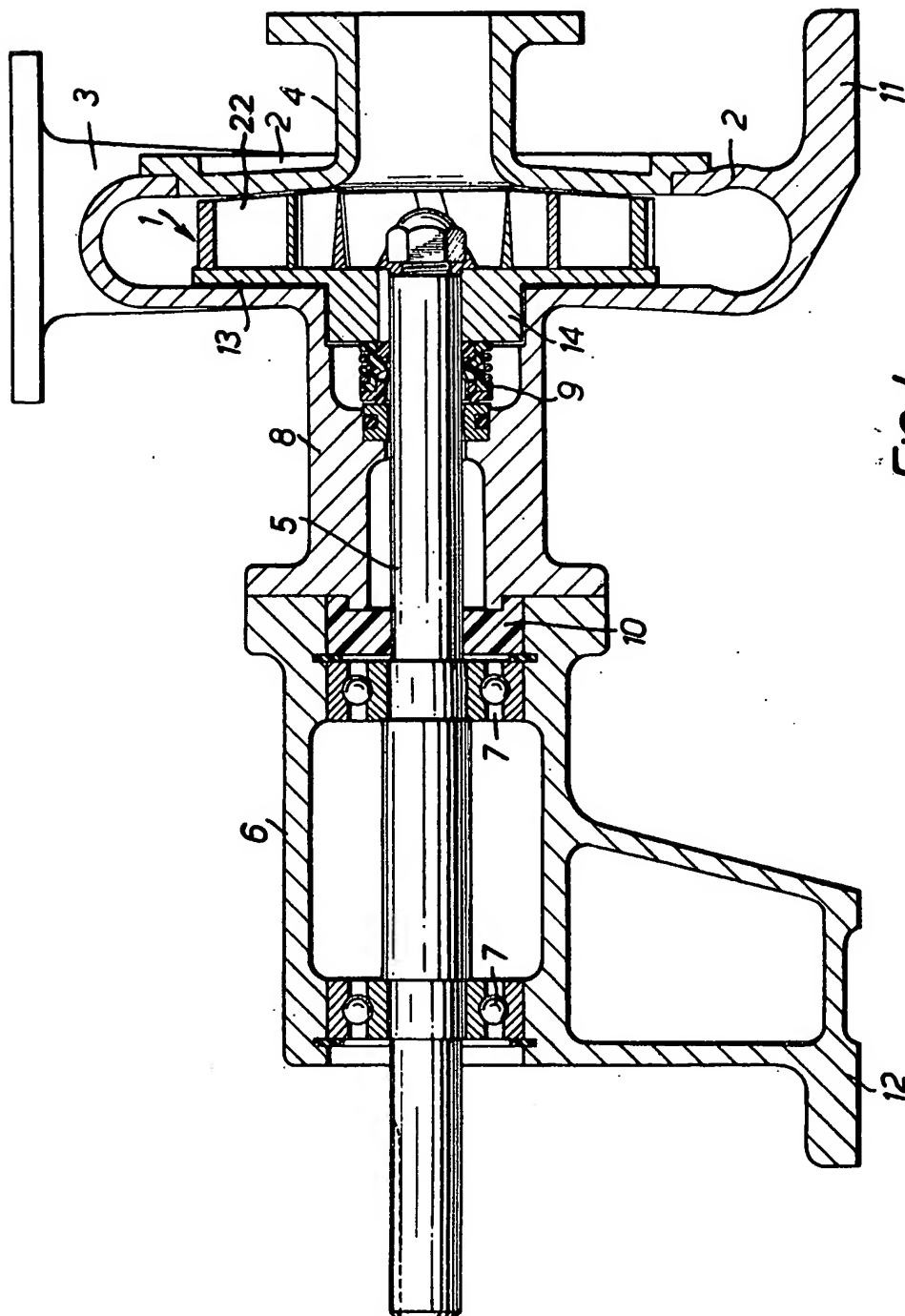


FIG. 1.